documented as yet. One retrospective epidemiologic study, however, failed to show efficacy in young children (aged 2 to 10) or high-risk adults, although the vaccine was protective in other patient groups.

Pneumococcal vaccine is indicated for immunization of patients at high risk of pneumococcal infection, including candidates for influenza vaccine, functionally asplenic patients (such as patients with sickling hemoglobinopathies) and selected other patients at high risk of pneumococcal infections (such as recurrent otitis media or nephrotic syndrome). Patients in closed communities (for example, nursing homes) are at increased risk of pneumococcal infection, and use of the vaccine should be considered in this setting as well. Unfortunately, this and other polysaccharide vaccines are relatively nonimmunogenic and ineffective in children younger than two years of age. The reimmunization interval has not been finally established but will probably be no more often than every five years. Toxicity has been mild and infrequent.

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## Small Cell Carcinomas of the Lung

APPROXIMATELY 8 percent to 15 percent of all types of primary lung cancer are of the small cell variety. They are characterized by aggressive clinical behavior and histological features that suggest their derivation from neuroectodermal tissue.

Fewer than 5 percent of these small cell tumors are detected at an asymptomatic stage; they typically grow very rapidly and metastasize early and widely—underlining the importance of establishing a histological diagnosis in patients suspected of having this disease. This can usually be achieved by means of sputum cytology, bronchoscopy, mediastinoscopy or aspiration needle biopsy.

Because of the tumor's rapid growth, results after resection are poor, and this type of malignancy is generally considered to be inoperable at any stage. However, relative success has been reported with nonsurgical therapy. Small cell types of cancer typically respond to combinations of chemotherapy given with or without radiation. Numerous therapy programs have shown good results, with survival of patients having been extended for several months and, in some cases, years. A "best" therapy has not yet been established.

Recently, interest has returned to surgical intervention as adjuvant therapy wherein the primary lesions are removed as part of a chemotherapy program. Because these are active and important areas of clinical investigation, patients should be treated in one of many centers where the results of various approaches can be evaluated.

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## Aspiration Pneumonitis

THE ASPIRATION of stomach contents can lead to serious consequences in patients with altered states of consciousness or abnormalities of swallowing or in those undergoing anesthesia.

Substantial quantities of fluid aspirated into the lung can cause acute respiratory decompensation. If the fluid pH is greater than 2.5, is free of food particles and is isotonic, recovery is likely. If it has a pH of less than 2.5, is hypertonic and contains food particles or nonparticulate food substances, a progressive inflammatory reaction may develop. Acid aspirates produce the greatest anatomic and physiological harm.

The causative role of infection remains unclear. If necrotizing pneumonia, lung abscess or empyema develops, then a heavily infected inoculum was probably aspirated. In patients not in hospital, the organisms are usually anaerobes; whereas, facultative anaerobes (Gram-negative rods) and aerobes are predominant in patients in hospital. A delayed infection may develop in some patients and is probably due to contamination of the chemically damaged lung by artificial airways, suction and mechanical ventilatory apparatus. *Pseudomonas aeruginosa* and *Staphylococcus aureus* are frequent isolates in these circumstances. There is no characteristic radiographic pattern in this disease. Severe hypoxemia is the predominant gas-exchange alteration.

In a surgical patient the preoperative administration of 400 to 600 mg of cimetidine has been

described as a useful tool to lower the risk of aspiration pneumonitis.

Endotracheal suctioning is an important initial therapeutic step. Because the aspirated material is rarely entirely removed, other therapeutic measures are also required. Bronchoscopy should be done on anyone who has aspirated particulate matter, especially if there is clinical or radiologic evidence of segmental loss in lung volume. Routine bronchial lavage with neutral or alkaline solutions is not effective, and the use of corticosteroids remains controversial. Although prophylactic antibiotics have been advocated, their effectiveness is doubtful because their use has demonstrated no proved benefit on ultimate outcome. A more logical approach is to closely monitor the patient for clinical and bacteriologic evidence of infection using uncontaminated specimens of tracheal aspirates.

When the patient's hypoxemia can no longer be corrected without using toxic levels of oxygen, positive end-expiratory pressure should be instituted. The actual level of pressure required will vary with each patient, but levels as high as 30 cm of water occasionally have been necessary. Barotrauma, such as pneumothorax, and impaired cardiovascular function should be anticipated and, when present, appropriately treated.

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## Long-term Use of Oxygen Therapy

OUTPATIENT OXYGEN THERAPY (OPOT) has improved the survival rate and neuropsychological function, as well as lowering pulmonary hypertension and erythrocytosis, in selected patients with hypoxemic chronic obstructive pulmonary disease (COPD). Continuous (21 to 24 hours per day) OPOT reduces mortality substantially as compared with the 12-hour (per day) regimen. Treatment programs providing less than 12 hours a day of OPOT have no proven benefit except for relieving subjective symptoms or improving exercise tolerance while the patient is breathing oxygen.

In most patients with COPD, improvement of hypoxemia will occur once pulmonary or cardiopulmonary exacerbations are properly treated. Short-term oxygen therapy is used during exacerbations until resting arterial oxygen exceeds 55 to 60 mm of mercury. When the patient's condition has been stable for a month following discharge from hospital, a decision regarding long-term OPOT should be made. Cor pulmonale, erythrocytosis, mental changes and sleep disorders are clues to possible persistent hypoxemia and a need for OPOT; however, these may be lacking or unrecognized.

Obtaining arterial blood gas measurements on several occasions during a one-month stability period will aid the prescriber in determining whether long-term OPOT is needed.

In selected COPD patients, OPOT will improve exercise tolerance. Most patients with COPD have exercise limitations and breathlessness unrelated to hypoxemia. There are no conclusive studies as to whether chronically hypoxemic and stable patients with diseases other than COPD benefit in a similar manner or degree from long-term OPOT.

Proper patient selection is important because OPOT is expensive ($200 to $400 per month) and easily mistaken as a panacea. Stable outpatients with an arterial oxygen pressure ($Pao_2$) of 55 mm of mercury or less are considered candidates for OPOT. A patient with a $Pao_2$ of between 55 and 60 mm of mercury may be treated when cor pulmonale or erythrocytosis is present. The adequacy of the prescribed OPOT dose should be established every three to four months. Oxygen supplementation should provide a $Pao_2$ of 60 to 80 mm of mercury. Careful patient education, often underemphasized, is essential.

OPOT is usually administered during sleep because there is a greater likelihood of severe prolonged desaturation during this time. A small increment to the daytime flow rates often is necessary to maintain adequate sleep oxygenation.

Cost, convenience and familiarity are the determining factors for choice of OPOT equipment. When properly instructed and monitored, OPOT has proved to be safe, with rare and usually minor problems. The new oxygen concentrator systems have the advantage of necessitating fewer home visits by the supplier. A portable back-up system should augment the concentrator because the latter is not mobile and is subject to electrical power failures.

Long-term OPOT, although beneficial for selected hypoxemic patients, is only one component of a